Simulation Support for Mission Planning

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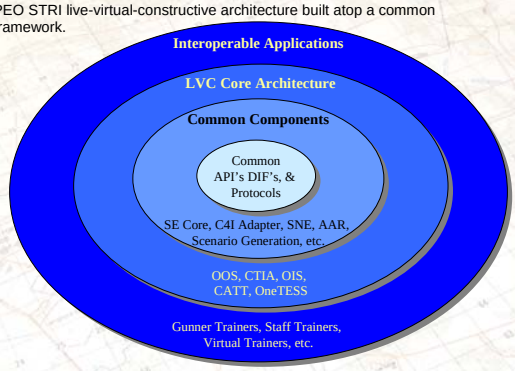
Agenda

- Military Simulation Overview
  - Framework and Tools
  - One Semi-Automated Forces (OneSAF) Overview
  - OneSAF in the Field
  - Impact of OneSAF
- Simulation Support for Mission Planning
  - Mission Planning and Rehearsal System (MPARS)
  - MPARS in the Field
  - MPARS Lessons Learned
- Simulation Support for Research
  - NetFires (NLOS-LS)
  - Combat Decision Aid System (CDAS)
  - Command and Control Architectures
  - Mission Planning
- Questions

Military Simulation Overview: A Common Framework

- PEO STRI live-virtual-constructive architecture built atop a common framework.



Military Simulation Overview: Simulation tools

- If you were to ask a Warfighting Commander to describe "Good Training," he/she would probably tell you it must be rigorous, meaningful, and realistic.
- The training also must be able to replicate wartime operations as much as possible. Due to yearly budget cuts and limited resources, however, commanders must find alternative means to train for combat operations.
- Simulation as a Training Tool
  - Since the mid-80s, simulation has been used as a training tool allowing the warfighter to compensate for the lack of funding and resources.
  - The Army is taking advantage of Semi-Automated Forces (SAF) simulations in the areas of training, analysis, and research.
  - SAF tools accurately and effectively represent the physical behaviors of joint weapons systems as well as the tactical behaviors of individual entities and military units.
  - SAF simulations also depict detailed models of natural environments (terrain and atmosphere) and the environmental effect on simulated activities and behaviors.

SAF Simulations

- A SAF is a constructive simulation that reduces the overhead required to run an exercise or an experiment.
  - Operators are not the training audience, but they are overhead.
  - Operators can assign tasks to entities that exhibit limited autonomy:
    - "clear a room," "move by traveling overwatch," "conduct support by fire," etc.
  - Hierarchical SAF Behavior
    - Can have a hierarchical structure of simulation entities.
    - Operator can issue orders to higher-level units.
    - This generates the appropriate entity behaviors and tactics with little further user action.
    - The user can, however, override or interrupt any automated behavior.
- The OneSAF program was created to build a single SAF capable of replacing all the others, reducing the logistics tail associated with maintaining many SAFs with overlapping capabilities.

One Semi-Autonomous Forces (OneSAF) Overview

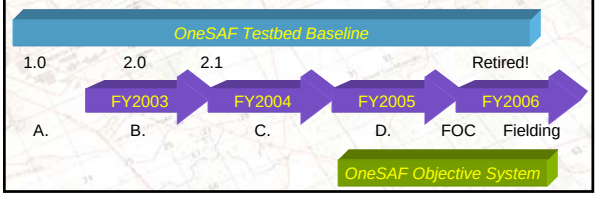
- Developing and Updating Simulation Tools
  - With an evolving Army mission, SAF tools are constantly in need of updating.
  - Current updates allow military training to accurately reflect modern warfare, terrain, and the resulting effects on the Warfighter
  - SAF tools also support analysis and research on developing Army platforms.
- The Army's primary agent for developing SAF simulations is the Product Manager One Semi-Automated Force (PM OneSAF) of the Program Executive Office, Simulation, Training, and Instrumentation (PEO STRI).

OneSAF: Serving Three Masters

- Training, Exercise, and Military Operations (TEMO)
  - Includes most forms of training at echelons from the individual soldier through collective, combined arms, joint and/or combined exercises
  - Includes mission rehearsals and evaluations of all phases of war plans
  - Includes analysis during the rehearsal or evaluation to validate the plan
- Advanced Concepts and Requirements (ACR)
  - Experiments with new concepts and advanced technologies to develop requirements in doctrine, training, leader development, organizations, materiel, and soldiers
  - Evaluates the impact of horizontal technology integration through simulation and experimentation
- Research, Development, and Acquisition (RDA)
  - Designs, develops, and acquires weapons systems and equipment
  - Performs scientific inquiry to discover or revise facts and theories of phenomena, followed by transformation of these discoveries into physical representations

OneSAF Consists of Two Separate Programs

- OneSAF Testbed Baseline (OTB):
  - An interactive, high resolution, entity-level simulation that represents combined arms tactical operations up to the battalion level.
  - Provides an interim solution to meet user's near-term requirements and to provide a vehicle for integration, testing, risk mitigation, and user feedback.
  - Will be replaced by the OneSAF Objective System in fiscal year 2006.
- OneSAF Objective System (OOS):
  - OOS is *not* just the next version of OTB – it is a completely new simulation!
  - A composable, next generation CGF that can represent forces from the entity to the brigade level.



OneSAF Testbed Baseline (OTB)

- OTB is an interactive, high-resolution, entity-based, legacy simulation that represents combined arms tactical operations up to the battalion level. It allows:
  - The user to create and control entities on a simulated battlefield.
  - A single operator to furnish computer-generated opposing, flanking, supportive, and subordinate forces in distributed simulations.
  - Simulated units to execute a considerable number of actions as outlined by their preprogrammed behaviors with minimal human intervention.
- Creation and Control of Entities
  - The SAF components communicate physical battlefield state and events among themselves through the simulation Distributed Interactive Simulation (DIS) protocol and command, control, and system information through the Persistent Object (PO) protocol.
  - The OTB simulation communicates physical battlefield state and events via simulation packets.
  - There are simulation packets for bundling entity state, impact, collision, fire, initialization, radar, and weather data.

ModSAF → OTB → OOS

- OTB serves as a bridge between the legacy SAF system (Modular Semi-Automated Force [ModSAF]) and the presently under development One Semi-Automated Force Objective System (OOS).
- OTB represents a major overhaul of ModSAF 5.0 code, including
  - the removal of non-functioning libraries,
  - the enhancement of outdated algorithms,
  - implementation of a native HLA interface, and
  - the implementation of major new SAF functionality.
- The update impacted nearly all of the existing ModSAF 5.0 libraries.
- To bridge the gap, an open-source solution has been established to maintain configuration management of current ModSAF capabilities.
- These open-source solutions enhance capabilities to support interim user requirements.
- OTB version 2.0 International will be available in Spring 04.
- OTB will reduce risk during OOS development by providing opportunities for integration test and user feedback on technology developments.

OTB as a Distributed System

- OTB runs on Linux and can be run on a single laptop.
  - The number of front-end GUI's and back-end simulations are an n:m relationship.
  - The entity count can be increased by adding more back-end simulations; however, there is a point (dependent on the types of entities being simulated) in which adding another back-end simulation does not increase the number of entities.
- Although the current architecture supports interface to servers (e.g. weapons effects), the OTB operates as a distributed system.
- Typically, there is no real client or server in the architecture.
- Workstations negotiate load balancing, and the distributed nature of the application allows recovery from individual system crashes without interruption to the simulation scenario in progress.
- Methods exist to participate in a simulation using distributed network architecture.
- OTB is easily configured using simple text files and can be modified in the field without needing to be re-compiled from the source code.
- The OTB is compliant with High Level Architecture (HLA) protocols via a DIS-HLA gateway.

OTB Utilization

- OTB can be used as a stand-alone simulation, or as an embedded system within a manned simulator.
- It can interact in a joint exercise with other live, virtual, and constructive simulations using the Distributed Interactive Simulation (DIS) and/or High Level Architecture (HLA) simulation standard.
- The OTB empowers trainers, analysts, and researchers to configure the simulation to meet their needs without total reliance on software developers.
- Each version of the OTB puts more and more power into the hands of the users, allowing them to tailor the application for specific requirements.
- A variety of the Army's modeling and simulation domains are utilizing OTB for purposes ranging from advanced concepts exploration to mission rehearsal.
- OTB is used at numerous U.S. sites and several international locations.

Example: USAAVNC – ATX/MRE and MDMP

- The US Army Aviation Center (USAAVNC) conducts an Aviation Training Exercise (ATX) for aviation brigade and battalion level staff/aircraft crews.
  - ATX provides a precursor to the Mission Rehearsal Exercise (MRE) that is conducted prior to deployment of units into Bosnia and Kosovo.
  - The ATX and MRE exercises focus on a commander's assessment of tasks that are critical for the success of the unit rotation into those areas.
  - All data threads from the last six months of significant events "in country" generate the basis for this analysis.
- MDMP Evaluation
  - OTB is used to create the interactive semi-automated forces needed to stimulate the Military Decision Making Process (MDMP) for all participants (crews, staff, command and control, etc) under the watchful eyes of Observer/Controllers (OC).
  - The OCs have performed OC duties at the Combat Training Centers (CTC) at NTC, JRTC, and CMTC.
  - These OCs conduct immediate feedback after execution (Hot Wash type events) and mentor the personnel they are assigned to observe.

Example: USAAVNC – Training Support

- As a result, Training Support Packages (TSP) are specifically generated to evaluate planning and execution of these tasks in a virtual synthetic training environment (STE) that replicates the environment (OPTEMPO, Aircraft OR rate, crew endurance, etc,) that the staff and crews will see in theater.
  - The TSPs incorporate missions like
    - Weapon Storage Sites (WSS) monitoring,
    - show of force missions to deter and disrupt civil disobedience from local civilians/non-combatants,
    - the exercise of the Graduated Response Matrix (GRM), and
    - theater specific Rules Of Engagement (ROE) for the use of deadly force.
  - The STE is created with the use of virtual aircraft simulators that are manned by the aircrews.
- The USAAVNC has conducted 17 iterations of these exercises to date, and exercises have been so successful that commanders specifically ask for them prior to deployment.
- The ATX process is expanding to include additional AORs that are developing in the world.

Example: USAAVNC – ATX AAR

- The OC conducts formal After Action Reviews (AAR) at designated times during the ATX.
- The AARs:
  - Provide performance evaluations keyed to the TSP developed specifically for the commander.
  - Create a thread that maintains the learning curve and OPTEMPO currently being executed in their respective Areas of Responsibility (AOR).
- All the training and the AARs are conducted using:
  - The OTB
  - A 3D "Stealth" viewer (a window into the virtual world)
  - Audio (radio calls)
  - Sensors (weapons acquisition systems replicated in STE)
  - Time-stamped playback for AAR to facilitate the learning curve
- This type of AAR provides the opportunity for all participants to learn from the MDMP event that was, or was not, executed correctly.
- This is a "picture is worth a thousand words" type event.

Example: USAAVNC – Looking to the Future

- OTB is the SAF to be used in the Flight School XXI (FSXXI) training initiative that is near implementation for USAAVNC.
- This enhances the Army helicopter pilot training by leveraging simulation technology for initial training of Army aviators at USAAVNC.
- The expanded OTB better prepares students to execute at a higher state of training readiness when that student does enter into the actual helicopter to execute techniques, tactics, and procedures (TTP) practiced and perfected in virtual simulation.
- The key to these training efforts is the SAF provided by OTB.
- OTB has been effective in all these use cases, but Ft. Rucker keeps an eye toward the growth potential provided by the Objective OneSAF System (OOS).

Challenges for OTB

- Like any project under continuous development, OTB is experiencing challenges.
- The most important challenge to the project is translating the needs of the Warfighter into software requirements that result in a product that provides the capability the Warfighter is searching for and is suitably user friendly.
- Satisfying the Warfighter needs with OTB is difficult because there is very little funding for further enhancements.
  - The user community typically funds all enhancements to OTB.
- The underlying architecture of OTB is limited in its future scalability and expandability.
  - For instance, OTB cannot run faster than real time. It is not built as a typical DES, and it cannot be sped up without ripping the guts out of it -- too expensive.
- Modification of behaviors in OTB requires rewriting code, a good knowledge of C and C++, and lots of under-the-hood OTB training.

OOS Development Methodology

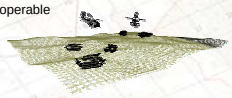
- OOS is being developed under a spiral development methodology in which each of four, approximately annual blocks add increasing functionality to the previous blocks.
- The fourth block, Block D, will achieve all the ORD requirements.
- Within each spiral (block) OOS implements a version of "extreme programming."
- These are eight-week spirals within spirals. Following an eight-week build cycle, the build is handed to the test and integration group that employs a combination of automated regression tests and manual test.
- Simultaneously the developers are working on the next build and correcting software bugs in the build that is being tested.
- Following the testing of a build, it is nominated to the Test Working Group as User Assessment Baseline (UAB).
- A UAB is a stable, tested version of the OOS software that has known, documented capabilities. Under certain circumstances we share UABs with co-developers.

OOS Development

- Development of OOS has used best practices from commercial software development, including:
  - spiral development
  - an implementation of "extreme programming,"
  - heavy reliance on open standards and open interfaces,
  - platform independent code (OOS runs on Solaris, Linux, and Windows 2000),
  - data storage and exchange through the use of the eXtensible Markup Language (XML).
- OOS development was built around four (roughly annual) blocks. Each block is further divided into eight-week builds.
  - Block B of OOS is currently undergoing block release testing; Block B will be distributed to selected "beta sites" in the second quarter of FY04. While Block B is going though its test paces,
  - Block C development has already commenced and will be completed the second quarter of FY05.
  - OneSAF fielding will begin 1st quarter FY 2006 to National Guard armories, reserve training centers, all active duty brigades, battalions, and international customers.

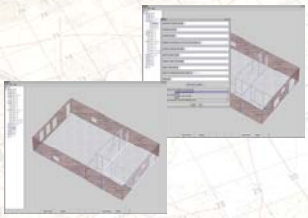
OneSAF Objective System (OOS)

- A composable, next-generation CGF with a new core architecture.
- Can represent a full range of operations, systems, and control processes (TTP) from entity up to brigade level, with variable level of fidelity that supports multiple Army M&S domain (ACR, RDA, TEMO) applications.
- Replaces legacy entity-based Simulations:
  - BBS, OTB/ModSAF, Janus, CCTT/AVCATT SAF, JCATS MOUT
- Features
  - Software only, platform Independent
  - Automated, composable, extensible, and interoperable
- Field to:
  - All Active Duty Brigades and Battalions
  - Reserve Training Centers
  - National Guard Armories
  - RDECs / Battle Labs
- Provides Leap-Ahead Capabilities over Current Simulations
  - Enhanced MOUT Capabilities
  - Enhanced Synthetic Natural Environment (SNE)
  - Enhanced, validated, user-accessible Modeling
  - Composability



OOS Enhanced MOUT Capabilities

- Enhanced DI SAF level behaviors
- Validated, physics-based modeling
- Ultra High Resolution Building (UHRB) models
- Integration of MOUT FACT developments

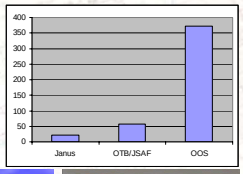


Screenshots Of UHRB Editor

OOS Enhanced Synthetic Natural Environment (SNE)

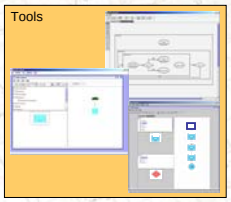
- Increased number of trafficability categories
- Increased number of attributes and features
- Enhancement of mixed fidelity terrain modeling

Supported Terrain Features in Various CGF's



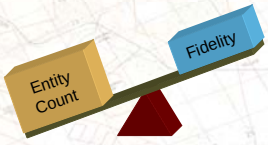
OOS Enhanced, Validated, User-Accessible Modeling

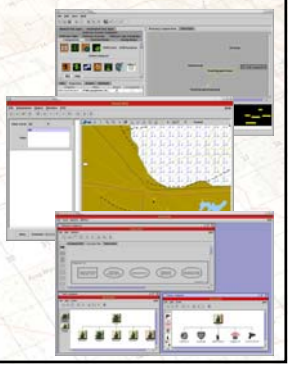
- All models in OOS have been validated by an authoritative source.
  - For physical models, AMSAA is the authoritative source.
  - Behavior models are validated by Training and Doctrine Command.
- Contemporary Operating Environment (COE) behavior models based on TSD design.
  - ADCSINT-Threats is conducting the analysis to accurately describe the behaviors of threat forces under the Contemporary Operating Environment.
- OOS provides tools that expose internal models to users and processes to assist users in enhancing and modifying the models.



OOS Composability

- Solution to the ORD Dilemma
  - System composer
  - Entity composer
  - Unit composer
  - Behavior composer





OOS Composability: Levels of Fidelity

- OOS supports three levels of fidelity that can be mixed within a simulation experiment: low, medium, and high.
  - Low fidelity entities are similar to those found in simulations like Janus, BBS, and JCATS.
  - Medium fidelity entities are similar to those found in SAF's like CCTT-SAF, OTB, etc.
  - High fidelity entities have significantly greater resolution and fidelity.
- OOS development involves testing to ensure that the interactions between entities of mixed fidelity are correct.
  - As an example, in a single simulation experiment, one could have
    - low-fidelity entities on the flanks, those entities that provide context for the experiment;
    - medium fidelity entities can be used in the area of interest;
    - and a small number of high-fidelity entities could be used to simulate the special operations forces involved in a tricky mission.
  - This allows the person running the experiment to "dial up" the level of fidelity where it is needed without bogging down the entire model.

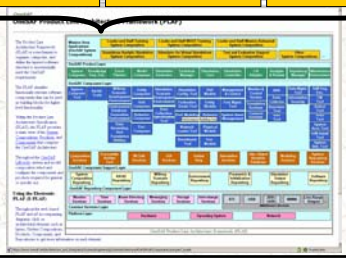
OOS Composability: Configurable Support

- "OOS is a Box of Tools"

Leader and Staff Training | **Leader and Staff MOUT Training** | **Leader and Staff Mission Rehearsal**

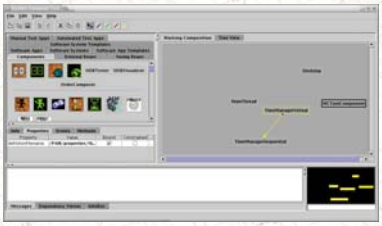
Standalone Analytic Simulation | **Stimulator for Virtual Simulations** | **Test and Evaluation Support** | **Other**

The OneSAF architectural approach facilitates meeting:
• current requirements
• future (as yet undefined) requirements



OOS Composability: Composer Tools – System Composer

- Allows the user to tailor OOS to meet the needs of the simulation experiment.
- Composition done through a GUI, drag-and-drop interface.
- Composition conceptually is the selection of "blue boxes" from the PLAF.
- Composition is described as an XML file.
- Changes to composition require NO recompilation of code.

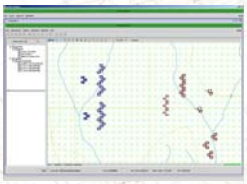


OOS Composability: Composer Tools – Entities and Units

- Entity Composer:
  - Allows users to create new entities or modify existing ones.
  - New entities are described as an XML file.
  - Composition done through drag-and-drop and right-click functionality.
  - Allows users to "attached" behaviors to entity.
  - New entities are available in OOS without recompiling code.
- Unit Composer:
  - Same as entity composer
  - Units can be made by combining previously-defined subordinate units (e.g., companies composed of platoons).
  - Sub units are pass by reference, so changing an M1 platoon will automatically update all companies containing that M1 platoon.

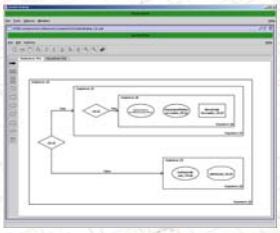
OOS Composability: Composer Tools – SSDE/MCT

- Simulation Scenario Development Environment (SSDE) Management and Control Tool (MCT)
  - Allows users to task entities and units
  - Allows multiple plan view displays (maps) so that a user can rapidly view multiple parts of the battle without a lot of panning and zooming.
  - Allows users to intervene in the execution of SAF behaviors
  - Provides status of entities, units, etc.
  - Built on top of OpenMap open-source product
  - Uses common drag and drop and right click modalities.
  - Written in Java Swing with additional GUI widgets developed locally



OOS Composability: Composer Tools – Behaviors

- Ovals represent behavior primitives
- Rectangles represent composite behaviors
- Diamonds represent decision/branch points.
- Branching implemented as a fuzzy rule base
- Composite behaviors are built and/or modified in the GUI by combining primitive behaviors, other composite behaviors, and branch points.
- Behaviors are stored as XML files.
- New and modified behaviors can be applied to entities and units without recompiling code.
- Syntactic checking done in tool to ensure that entity behaviors are not applied to units, for instance.



OneSAF Impact: Empowering …

- The Current Force and Future Force:
  - AVCATT, CAV SIM, VERTS,
  - FCS Analysis, FCS Embedded Training
  - Battle Laboratory Constructive Simulation Environment (BLCSE)
  - Army Constructive Training Federation (ACTF)
  - Modeling Architecture for Technology, Research and Experimentation (MATREX)
- Joint
  - JSAF, SAGIS, CFFT, JVB, DI SAF
  - Building Air Force and Marine Behaviors
  - USMC – CAST UP, CACCTUS, & DVTE
  - Discussions with Navy and US Coast Guard
- Our Allies

OneSAF Impact: OOS Emerging Standards

MSDL – Military Scenario Definition Language
Defines the language between tools & simulations to provide military scenario information to OneSAF. Currently MSDE, C2PC and CAPES interoperate with OTB & OOS using MSDL. Future efforts to include FCS C2 systems and Battlefield Mgmnt Language (BML) integration.

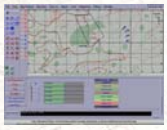
OTF - Objective Terrain Format
Defines the OOS Synthetic Natural Environment. Provides a common LVC environmental representation for USA simulations (CATT / AVCATT / CTIA / WARSIM / Combat XXI) and federations (ACTF / BLCSE / MATREX).

PLAF - Product Line Architecture Framework
A modular, composable architecture with well defined APIs and data schemas for all components. Supporting current USA & USMC constructive & virtual simulation development.

SORD – Simulation Object Runtime Database Contains shared battlespace objects, which include platforms, units, dynamic environment objects (smoke clouds, obstacles) missions, orders, and reports. Provides ability for any SORD client to access the data in the OOS database if it has properly expressed interest for those objects.

Mission Planning and Rehearsal System (MPARS)

- A collection of user-focused tools, based on familiar applications, developed to provide support for the military decision making process.
- Useful in operational course of action development and analysis.
- Provides traceability of exercise objectives from planning through after-action review.



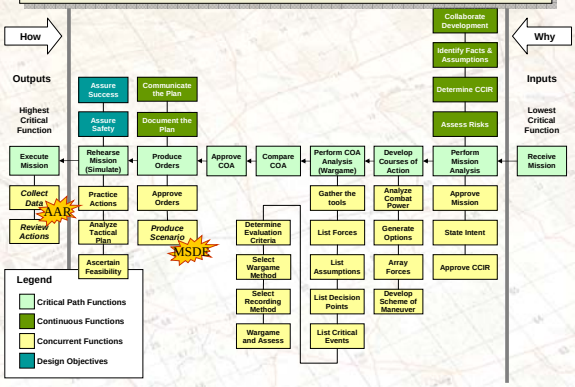
Simulation Engine (OneSAF)

Stealth Viewer (AcuScene)

Scenario Editor (MSDE)

After-Action Review (Power Stripes)

MPARS: The Military Decision Making Process (MDMP)



Combined Arms Planning and Execution System (CAPES)

- CAPES
  - CAPES is ideally suited to do collaborative planning at the Brigade and above level and to do COA development and analysis.
  - CAPES uses tables and heuristics to execute, "simulate," and compare COAs.
- MPARS
  - MPARS provides a basic planning capability that is not as robust and full-featured as CAPES.
  - MPARS, on the other hand, can read a (chosen) COA from CAPES and do a higher-fidelity simulation of the COA for more detailed analysis or to conduct (potentially) distributed rehearsals.
  - MPARS can be used like a sand table to allow commanders and staffs to walk through the plan and work out coordination and time/space relationships.
  - MPARS also includes an AAR tool to help analyze the COA execution/rehearsal.

MPARS Simulation Engine (OneSAF)

- OneSAF provides the underlying simulation support.

MPARS AcuScene

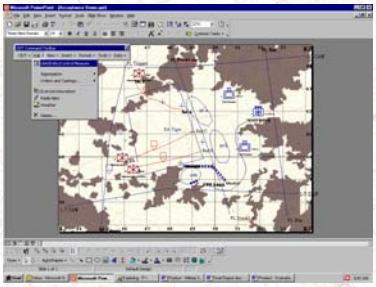
- AcuScene provides the 3D visualization tools
- AcuScen use cases:
  - OC's during battle
  - AARs after battle
- Includes stealth viewing
- Team OneSAF is collecting 3D model repositories from CCTT, AVCATT, CAV SIM, ABCA, etc.

MPARS Military Scenario Development Environment

- Military Scenario Development Environment (MSDE)
  - A result of the reuse of the close combat tactical trainer (CCTT) Exercise Initialization Tool (CEIT).
  - Supports the definition of application-independent military scenarios for use in simulations.
- Strategy:
  - Don't change the tools in use today, make those tools better:
- Make the tools follow the MDMP process already in use
  - Reuse of MS PowerPoint as the *de facto* standard for planning and overlay development
  - Reuse of MS Word for OPORD development
  - Reuse of MS Access for database generation
  - Reuse of applicable familiar standards
    - XML-based human readable scenario files
      - The military scenario development language (MSDL)
    - MIL-STD-2525B (symbology and data)

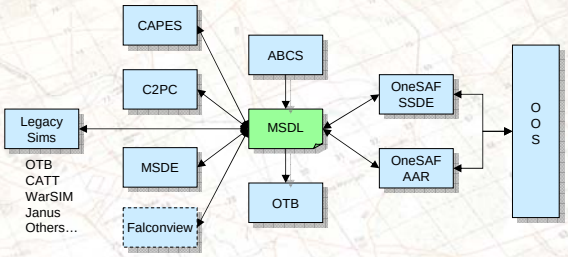
Military Scenario Development Environment (MSDE)

- Users import a terrain database and XML-encoded order of battle information.
- Tool bars allow users to create control graphics and other planning information.



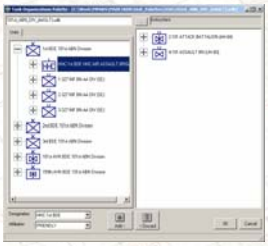
MPARS MSDE: Military Scenario Development Language

- Military Scenario Development Language (MSDL)
  - "Committed to Open Standards"
  - Formatted in XML.
  - Utilized to exchange scenario data for interoperability across systems



MPARS MSDE: Task Organization

- Extensible Unit Selection Capability
  - MTO&E
  - CCTT
  - OneSAF
  - OTB (Future)
- Flexible Task Organization Capability
  - Detach
  - Attach
  - Remove subordinates

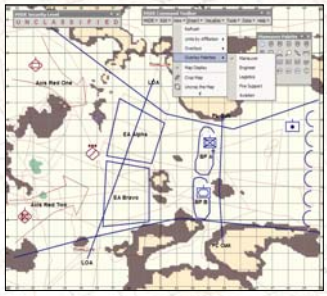


MPARS MSDE: Terrain & Maps

- Wizard-based terrain selection
- Supports
  - Compact terrain database (CTDB), close-combat tactical trainer (CCTT), scanned maps, and SEDRIS transmittal format (STF)
- Integrates OTB terrain reasoning
- Correlated to provide military grid reference system (MGRS) support
- Integrated with Slide Master

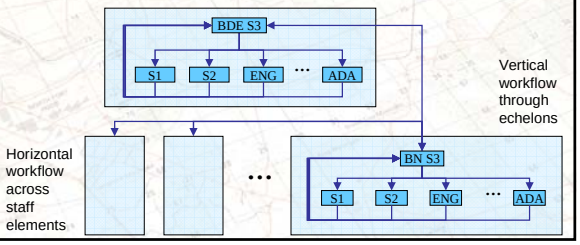
MPARS MSDE: Overlays & Control Measures

- PowerPoint native drawing behavior.
- Drawing Palettes organized by battlefield operating systems (BOS).
  - Maneuver
  - Engineer
  - Aviation
  - Fire Support
  - Logistics
- Integrated Editing
  - Drag & drop
  - Dialogs for manual editing



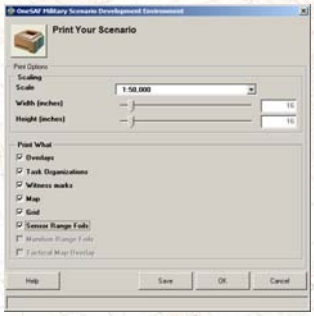
MPARS MSDE: Collaborative Scenario Planning Flow

- Users can conduct parallel planning, since user's work areas can be shared. This provides a mechanism for parallel planning that should speed the process of COA development and COA analysis.
  - The Brigade S-3 can sketch out a brigade course of action (COA) and then export that plan to the battalion S-3s.
  - The Battalion S-3s can plan within the constraints of the brigade plan.
  - Each of the other S-3s and the brigade S-3 could have visibility on the plan.



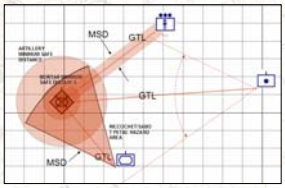
MPARS MSDE: Print Overlays and Maps to Scale

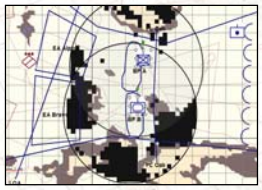
- Print from 1:25,000 to 1:500,000
- Any printer, any supported paper size
- Print selections include:
  - Map
  - Overlay
  - Task organization
  - Grid/witness Marks
  - Engagement/sensor range



MPARS MSDE: Integrated Visualization Tools

- Three Dimensions
  - Displays the unit lay-down in 3D.
- Intervisibility
  - Displays sensor and engagement range fans.
- Battle Space Geometry
  - De-conflicts fires and maneuver.





MPARS: Mission Rehearsal

- Given a final plan, a simulation (e.g., OTB today and OOS at the end of FY2005) makes possible distributed rehearsals that are not feasible in the current, manual process.
- The current process of conducting a rehearsal involves key leaders standing around a large map made of sand bags, rocks, etc.
- The key leaders walk across the map as the commander describes execution of the plan from phase to phase.
- This is barely sufficient for maneuver rehearsals but does not provide much insight for fire support or other rehearsals.
- The use of a simulation puts some science behind the rehearsal.
- Time-space relationships cannot be influenced by wishful thinking; the rates of movement and times necessary to fight battles are based on the validity of the underlying simulation models not the best guesses of staff officers.

MPARS: Mission Rehearsal

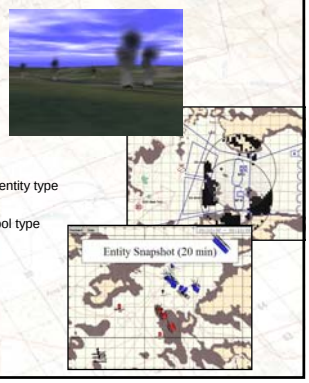
- Once the scenario is completed in CAPES/MSDE, it is then exported into OTB to conduct a simulation-supported rehearsal.
- Currently, only units designated to be simulated within CAPES/MSDE prior to export and standard operational graphics available using the various tool bars within CAPES/MSDE will appear in the simulation.
- Any additional graphics or units that were added using normal Powerpoint tools must be manually added to the simulation.
- Currently, all tactical orders must be manually assigned to units in the simulation. There is no automatic transfer of any operational instructions other than positioning from CAPES/MSDE to OTB; although, there is ongoing development at PMO OneSAF to provide this capability
- OTB imposes entity count restrictions.

MPARS: After Action Review (AAR)

- The OneSAF after-action review (AAR) component:
  - Resulted from the reuse of PowerSTRIPES, a tool that was the culmination of work including STAARS, ADST, GEMS and other research initiatives.
  - Provides users with familiar COTS interfaces incorporation of simulation outputs.
  - Allows the analyst to pre-plan the AAR by selecting review topics and high-interest events prior to exercise execution.
  - Provides the capability to correlate, roll-up, and analyze simulation outputs and visualize the results of the simulation during and after the exercise.
  - Allows users to automatically build presentations with products-based data retrieved from the execution of an exercise, and greatly reduces the time between the end of the exercise and AAR presentation.
  - Automatically builds take-home packages using COTS office automation tools.

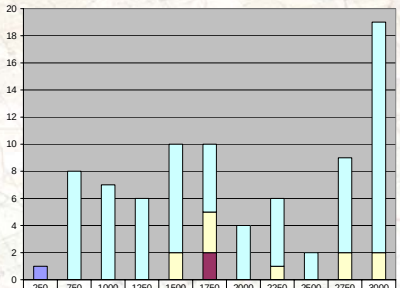
MPARS AAR: Display & Replay

- 3D Display/Replay
  - Utilizes OTB PVD
  - Start, Pause, Resume, Stop
  - Replay specific events
  - Utilizes DIS Stealth standards
  - Attach/Tether
  - Overwatch point support
- Generation of Map Views
  - Unit/entity lay-down by snapshot
    - Selection by echelon and unit/entity type
  - Overlays & control measures
    - Selection by overlay and symbol type
  - Snail trails
    - Units and entities
  - Battle summaries
    - Start/stop time
    - Snapshot Interval
  - Integrated replay



MPARS AAR: Generation of Statistical Charts and Tables

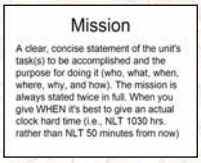
- Excel Based
  - Tables
  - Charts
  - Both



	250	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
USA_120MM_M830_HEAT		8	7	6	8	5	4	5	2	7	17
USA_120MM_M829A2_SABOT					2	3		1		2	2
M789 HEDP						2					
AGM-114A	1										

MPARS AAR: Generation of OPORD Extracts

- Supports OPORD Excerpts :
  - Description
  - Commander's Intent
  - Concept of Operation
  - Mission
- Generates Task Organization
  - Selectable by
    - Force (Friendly, Opposing…)
    - Level of Echelon
    - Unit Type



MPARS AAR: Enhancements

- Radio/audio playback
- Integrate full 2525B symbology support
- Correlate planned events with execution thru event detection of execution matrix synchronization events.
- AAR Author
  - Wizard based AAR templates Building
  - Planning in MSDE
  - Execution during simulation
  - Hot wash after simulation
  - Post exercise (at home)
- Situational Awareness
  - Battle Space Geometry
  - Sensor and Munitions Range Fans
- Replications/COA Analysis
  - Across multiple exercise runs

MPARS to the 101st Div (AASLT): Overview

- 101st Requirement:
  - "A Training Package configured to support simulation and collaborative mission planning and rehearsal through a networked capability."
- Time expenditure
  - Today: 16 hours to plan and rehearse
  - Goal: 50% reduction

101st ABN Div (AASLT) Mission Planning & Rehearsal System (MPARS)

Tools Available

MSDE	OTB	PowerStripes	AcuScene
• Home station • While deploying • While deployed • MS Office based	• Entity level simulation • Home station • While deployed (when loaded on notebooks)	• AAR • Configurable • While deployed • MS Office based	• Provides 3D Vision • Tethered to Entities

Specifically customized to 101st ABN Div (AASLT) task organizations and units

MPARS to the 101st: PEO STRI Support

- PEO STRI was developing the OneSAF Objective Simulation (OOS) and had developed several tools in support of OOS that, when integrated, could provide extremely valuable tools in support of the MDMP.
- In its' original configuration as developed by PEO STRI, the Mission Planning and Rehearsal System (MPARS) consisted of four integrated software tools developed in support of the work on the OneSAF Objective Simulation.
  - The Military Scenario Development Environment (MSDE)
  - The OneSAF Testbed Baseline (OTB)
  - The PowerSTRIPES AAR tool
  - The AcuScene stealth 3D viewer.

MPARS to the 101st: Fielding and NET

- MPARS equipment and software was fielded to the entire 101st Air Assault Division down to battalion level.
- MPARS hardware and software were fielded during three separate fielding windows to units within the division.
  - Each time the software package was improved over the last version with the goal of improving the deliverable to users upon completion of the last fielding.
  - The fielding was done directly to the operator/user level.
- New Equipment Training
  - MPARS seven day New Equipment Training (NET) period consisted of four days of operator training on the three primary software subcomponents: MSDE, PowerStripes and the OneSAF Operational Testbed Baseline (OTB) version 1.
  - Following the operator-level training on the software subcomponents, users broke down into operational sets and conducted a Command Post Exercise (CPX), exercising planning, rehearsal and AAR production exercise.

MPARS to the 101st: Shortcomings

- Upon the completion of training and fielding to the 101st Airborne Division, it became apparent that MPARS had shortcomings that needed to be addressed prior to it being adopted as a totally viable operational mission planning tool.
- Operational planners provided input about system shortfalls
  - ONS submitted addressing 27 specific system shortfalls/upgrades
- One major concern was that MPARS had no connection to the ABCS suite of equipment being utilized as execution tools within the Army's operational force.
- A second concern was that the current OTB would only run a constructive rehearsal in real time.

MPARS: Shortcomings

- Deficiencies fell into 6 major categories:
  - OneSAF Testbed Baseline (OTB) only runs at real time, not faster
  - OTB provides insufficient entity count for an entire brigade
  - Some entity behaviors need to be corrected or enhanced.
  - MSDE/OTB require correlated terrain databases
  - MPARS did not have ABCS interoperability
  - OTB too difficult for the average user
- 101st Plan to Address Shortcomings
  - 101st decided to integrate CAPES as front-end planning tool to help address many of these issues rather than enhancing MPARS directly
  - Provided initial link from CAPES to OTB/OOS
  - Improved CAPES functionality

Most of these deficiencies will be addressed when OneSAF Objective System (OOS) is completed.

MPARS: Enhancements

- MSDE
  - Integrated scenario library and catalog capability
  - Execution matrix
    - Course of action (COA) definition
    - Battle management language (BML) Support
  - AAR authoring
    - Identification of COA with decision points
  - Full MIL-STD-2525B Support
  - Data harvesting and translation support
    - Legacy scenarios
    - Army battle command systems (ABCS) data interchange (DI)
- Military Scenario Development Language (MSDL) Enhancements
  - This is the mechanism by which plans are communicated between CAPES and MPARS
  - Needs to support tasks, not just units, order of battle, and graphics (FY04 work)
  - Needs to be two-way
  - If done well, this may become the de facto Battle Management Language (BML)
  - We are working with the SIMCI BML group
  - We are beginning discussions with PEO C3T

MPARS: Enhancements

- Enhance MPARS AAR Capabilities
  - Allow users to define AAR data collection templates and AAR display
  - Provide event authoring and event triggered data collection
    - Commander's Critical Intel Requirements (CCIR) oriented
    - AAR needs to respond to event triggers in context of the authored events
  - Include some Artificial Intelligence in AAR tools
  - Faster than real-time recording
  - Multi-Cell Database
    - Not supported for scenario planning, AAR, or 3D Visuals
  - Sharing Common Terrain
    - No system level solution for sharing terrain for OTB
      - Planning, AAR, 3D, SAF, CAPES
    - OOS does have a system wide solution (EDGE)
  - Scenario Transfer/Management
    - Managing the MSDL scenarios is entirely a manual process for MPARS (no system-wide solution)
    - OOS will solve this problem for MPARS

MPARS Other Items

- MPARS fielded to Infantry School for Captain's Career Course.
- Timelines and methodology for upgrades developed and coordinated.
- Funding procured on 17 JAN 03 to enhance system – nearly all of this money was spent on CAPES enhancements and integration with MPARS .
- MPARS and FCS
  - OOS has been chosen as the embedded simulation tool of the Future Combat System (FCS).
  - OOS will be delivered to all customers, not just MCS, with all those components commonly referred to as MPARS.
  - FCS IPTs other than the Training IPT are starting to realize that if you have a simulation already embedded in the vehicle you can use it for other purposes, such as COA development, COA analysis, and rehearsals.
  - If MPARS is incorporated into MCS, the current and future force will be sharing the same tool.
  - This will facilitate interoperability and rapidly deliver a "leap ahead," future capability to the current force at little cost.

MPARS Conclusions

- The ability to train our Warfighters in times of economic and resource strain has become a commander's number one challenge.
- Commanders are turning to SAFs to provide realistic training.
- In doing so, they are taking a giant step from the traditional Field Training Exercise (FTX) to the simulation environment to provide "Good Training" for our sons and daughters.
- Simulation is a small price to pay for preparing our sons and daughters for harms way and to ensure they return home safely.
- OneSAF Testbed Baseline is an important building block in supporting the Warfighter today while PM OneSAF builds the SAF of the future, OneSAF Objective System.

NetFires Overview

NetFires: System Concept

New Military Capability
- Immediate firepower
- 5x-10x kills per ton vs current ordnance
- Large zone of influence
- Multimode seekers
- In-flight targeting
- Duration weapon

Family of Missiles

- Loitering Attack

- Precision Attack *(Others possible)*

Designed for Deployability
- Logistic efficiency through containerization
- No platform or crew required

Low Cost
- Reduced personnel and vehicles - LCC reduced > 50%
- CAIV design process
- Commonality of components and assembly

Modular Vertical Launch
- Self locating / orienting
- Unmanned operation
- Not platform specific
- Can be vehicle appliqué

Containerized vertical launch provides immediate heavy firepower for early entry forces

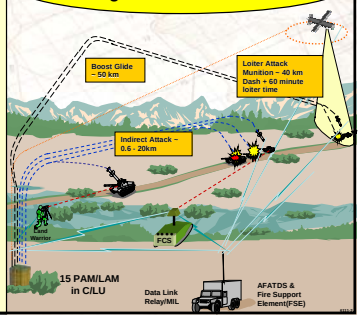
NetFires: Family of Missiles

- NetFires Loiter Attack Missile (LAM)
  - 7" diameter, 55" long, 100 lbs
  - Range - In Excess of 100km
  - 20 Minute Loiter at 100km
  - LADAR, UCI2R Seeker with ATR and SAL, GPS/INS
  - Data Link for Video, BDA and Targeting
  - Small (<8 lbs) Warhead
- NetFires Precision Attack Missile (PAM)
  - 7" diameter, 55" long, 100 lbs
  - Ranges up to 50 km
  - Variable Thrust Motor for Max Range or Quick Response Modes
  - UCI2R Seeker with ATR and SAL, GPS/INS
  - Baseline Warhead Design is 29 lb Unitary, with Growth to 56 lbs

NetFires: Goal in FCS

Demonstrate two LOS/NLOS weapons
- **Rapid Response PAM ("virtual direct fire")**
  - **Short time of flight (100s/25km)**
  - **Multimode terminal guidance**
  - **Low cost configuration**
  - **LOAL**
- **Hunter Killer LAM**
  - **3-D LADAR seeker w/ATR, TERCOM**
  - **Significant loiter**
  - **Multi-mission including BDA**
- **PAM/LAM**
  - **GPS/INS guidance**
  - **Variable propulsion**
  - **Terminal guidance (end game)**
  - **Midcourse update through networked 2-way data link**
- **Platform independent launcher**
- **Container command and control**

This fundamentally "reengineers close combat."



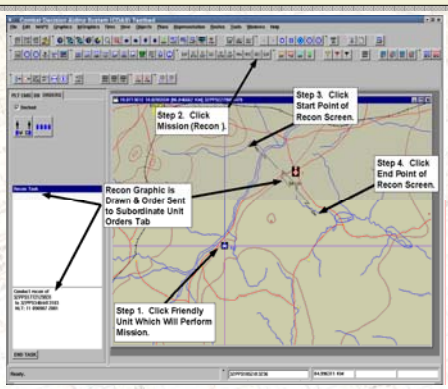
NLOS-LS Containerized Launch Unit (CLU)

- Non-Line Of Sight Launch System
- CLU Features
  - Vehicle independent design - HMMWV payload, flat rack, or unattended
  - 15 missiles in 4x4 reloadable rack
  - Vertical launch technology with missiles in sealed canisters
  - Networks with missiles and maneuver/control elements

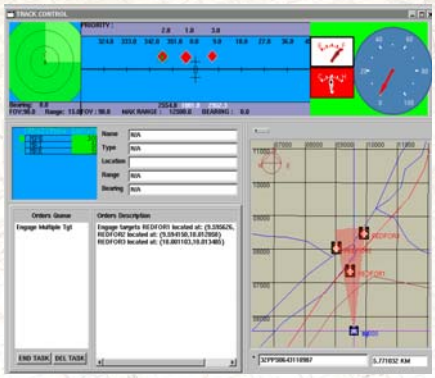
Combat Decision Aid System (CDAS) Overview

- Combat Decision Aid System (CDAS) was developed at Picatinny Arsenal in support of Objective Force Warrior (OFW).
- The CDAS code, which runs on the Linux operating system, has been made available to us to determine if the ideas developed in CDAS might be of use in the Netfires project.
- CDAS needs an external feed of the current situation in order to perform weapon-target pairing under constraints of the current control measures and set of current execution synchronization events.
- Our team will drive the CDAS current situation with the modified OneSAF Testbed Baseline that includes Future Combat Systems.

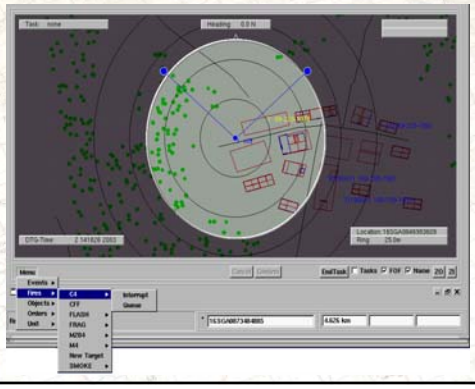
CDAS: Testbed



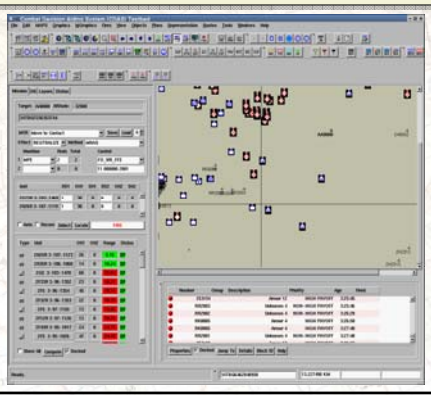
CDAS: Targeting



CDAS: OFW Combat View



CDAS: Netted Fires Workstation



Simulation Supported Projects will focus on:

- Investigating techniques for achieving networked effects-based-fires in support of operations.
- Comparing command and control architectures for the Loitering Attack Missiles under different connectivity and autonomy conditions.
- The information fusion problem and how the fusion results affect the NetFires weapon-target pairing problem.

Questions?

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